ADVANCES IN LABORATORY DETECTION OF *TRICHOMONAS VAGINALIS*

***Trichomonas vaginalis*, a protozoan parasite, is the most prevalent non-viral sexually transmitted infection in the United States and worldwide, and the cause of the curable sexually transmitted disease (STD), trichomoniasis. Available diagnostics for *T. vaginalis* range from basic microscopy to nucleic acid amplification assays. Considerations for laboratories include the sensitivity and specificity of each assay, as well as the cost to perform the assay. Trichomoniasis is not a reportable or nationally notifiable condition.**

Clinical Information

Trichomoniasis can cause urethritis in men and vaginitis in women, although the majority of infections are asymptomatic.[1] Extragenital infections (e.g., oral, rectal) are uncommon. Infection with *T. vaginalis* is associated with increased acquisition and transmission of HIV[2] and other STDs[3] and linked with preterm delivery of low birth weight infants.[4] Trichomoniasis can be cured with nitroimidazole antibiotics (e.g., metronidazole or tinidazole), usually in a single dose.[5] In addition, all sex partners of infected individuals should be treated concurrently, to prevent reinfection.[5] Although there have been infrequent reports of low level *in vitro* resistance to nitroimidazoles, correlation with clinical outcomes is inconsistent.[6]

Epidemiology

An estimated 3.7 million women and men are infected with *T. vaginalis* in the United States.[7] Among women aged 14–49 years participating in the National Health and Examination Survey (NHANES), the prevalence of *T. vaginalis* infection measured by PCR was 3.1% overall, and varied considerably by race: 1.3% for non-Hispanic white women, 1.8% for Mexican-American women, and 13.3% for non-Hispanic black women. Other significant correlates of infection included increasing age, a greater number of lifetime sex partners, lower educational level, poverty, and douching.[1]

Diagnostic Methods

The traditional diagnostic method for trichomoniasis has been **wet mount** with microscopic visualization of motile *T. vaginalis* parasites on slide preparations from vaginal or urethral secretions. Ideally, specimens should be examined within 10 minutes to observe motile parasites, which are diagnostic. Wet mount is an inexpensive diagnostic test; however, sensitivity is estimated at 51-65%, and varies based on the individual performing the test and how promptly the slide is interpreted.[8,9]

Culture has been considered the gold standard for diagnosis of trichomoniasis with a specificity approaching 100%, but it is not widely used and its sensitivity can be as low as 75–96%.[8,9] Clinical specimens can be inoculated into transport systems such as Amies gel medium to maintain viability for up to 24 hours at room temperature.[10] Culture systems such as InPouch TV (BioMed Diagnostics, San Jose, CA) allow for direct inoculation, culture and microscopic examination. Additionally, these systems can be used to transport specimens after inoculation. Such systems are useful when immediate transportation of specimens to the laboratory is not available. The specimen should be inoculated as soon as possible (within an hour of collection) to maintain viability of the organism.

Neither conventional nor liquid-based **Papanicolau (Pap) smears** are suitable for routine screening or diagnosis of *T. vaginalis*, because sensitivity is poor; in addition, positive predictive value is low in settings where the prevalence of infection is low.[11]

The OSOM (formerly Xenostrip) Trichomonas Rapid Test (Sekisui Diagnostics, Framingham, MA) is an immunochromatographic capillary-flow enzyme immunoassay dipstick test and the only **rapid antigen test** commercially available in the US. It is performed on vaginal secretions with results available within 10 minutes. This point-of-care test is FDA-cleared for females and CLIA waived. Test specifications include sensitivity 82–95% and specificity 97–100%.[8,12]

The Affirm VPIII Microbial Identification Test (Becton Dickinson, Franklin Lakes, NJ) is an FDA-cleared **nucleic acid probe** test for the diagnosis of three causes of female vaginitis: *T. vaginalis, Gardnerella vaginalis* and *Candida albicans*. Sensitivity for *T. vaginalis* is 63% and specificity 99.9%.[13] This is considered a same-day test as it produces results in 45 minutes; however, it is characterized as a CLIA moderate complexity test.

Nucleic acid amplification tests (NAATs) are the most sensitive tests available for detection of *T. vaginalis*. The APTIMA Trichomonas vaginalis Assay (Hologic Gen-Probe, San Diego, CA) was FDA-cleared in 2011 for use with urine, endocervical and vaginal swabs, and endocervical specimens collected in the Hologic PreserveCyt solution (ThinPrep) from females only. Sensitivity is 95–100% and specificity is also 95–100%.[8, 13, 14] The BD ProbeTec Trichomonas Vaginalis Q^x Amplified DNA Assay (Becton Dickinson, Franklin Lakes, NJ) launched in Europe (EU cleared) in 2012, but is not FDA-cleared in the United States at this time.

Diagnosis of *T. vaginalis* in men has been challenging given the low sensitivity of microscopy and lack of FDA clearance to date for any NAATs or point-of-care tests for use with male specimens. Some laboratories have verified the performance characteristics of NAATs through a validation process for male urine specimens or penile-meatal swabs. Culture of urine, semen, and/or urethral swabs may be other diagnostic options for men.

Screening and Treatment

Current recommendations for *T. vaginalis* testing and screening, along with detailed clinical treatment recommendations, can be found in CDC's STD Treatment Guidelines, available online at: http://www.cdc.gov/std/treatment

Table 1: Overview and characteristics of diagnostic assays for *Trichomonas vaginalis**

Diagnostic Test	Technique	Time to Result	Specimen	Sensitivity	Specificity	Comments
Wet mount	Microscopic visualization	Minutes	Vaginal or urethral discharge	51–65%	up to 100%	Inexpensive; technician-dependent
Culture	Culture media	24–120 hours	Vaginal or urethral swab	75–96%	up to 100%	Considered diagnostic gold standard in the past
OSOM Trichomonas Rapid Test	Immunochromatographic capillary-flow enzyme immunoassay dipstick	10 minutes	Vaginal swabs or saline for wet mount	82–95%	97–100%	CLIA-waived for females; can be used at the point-of-care
Affirm VPIII Microbial Identification Test	Nucleic acid probe test	45 minutes	Vaginal swabs	63%	99.9%	Moderately complex same-day test; FDA-cleared for use with specimens from females; also detects *Gardnerella vaginalis* and *Candida albicans*
APTIMA Trichomonas vaginalis Assay	Transcription Mediated Amplification (TMA)	Hours	Urine specimens, endocervical and vaginal swabs, and specimens collected in PreservCyt Solution	95–100%	95–100%	NAATs are the most sensitive tests; FDA-cleared for use with specimens from symptomatic or asymptomatic females
BD ProbeTec Trichomonas vaginalis Q^x Amplified DNA Assay	Strand Displacement Amplification (SDA)	Hours	Not an FDA-cleared product			Variety of female specimens have been tested
PCR	Polymerase Chain Reaction	Hours	No FDA-cleared kit			Variety of male and female specimens have been tested

*Ranges of sensitivities and specificities were summarized for multiple specimen types and include comparisons to multiple methods, based on published data (i.e., unpublished data from package inserts were not included).

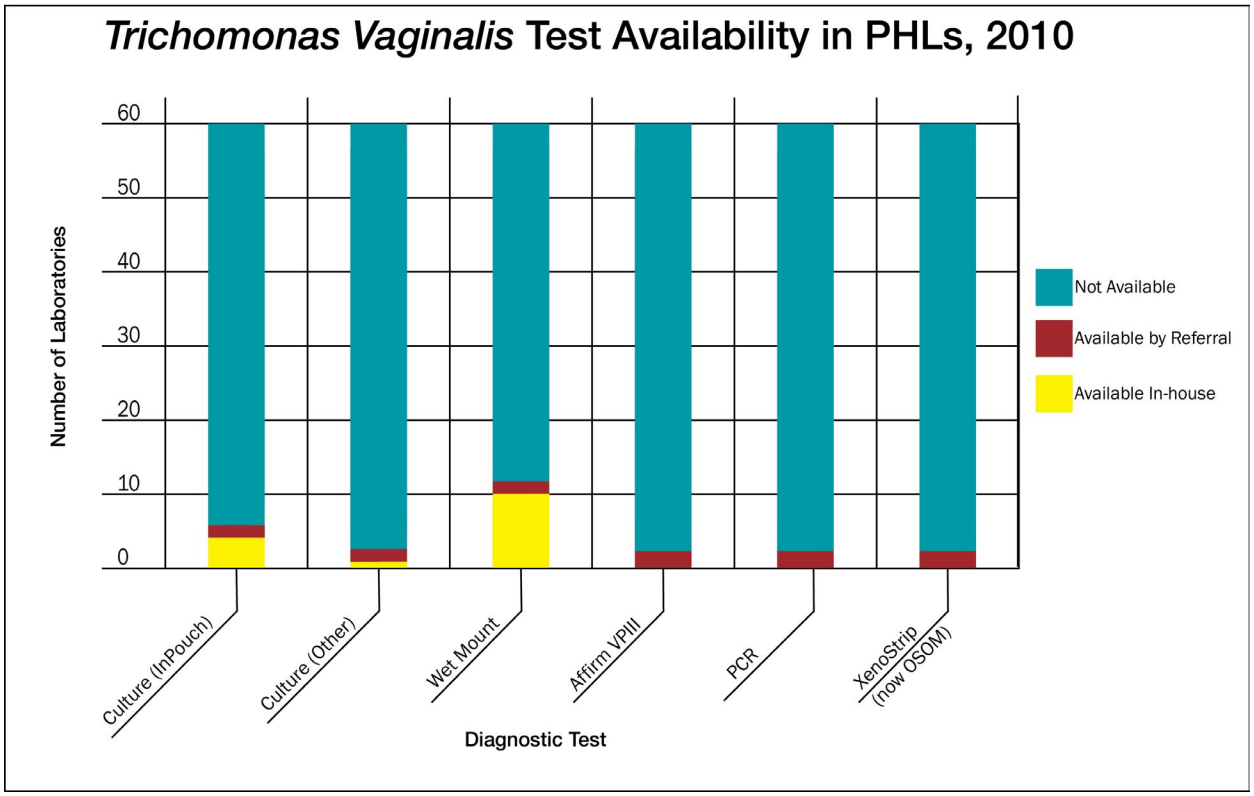
Trichomonas vaginalis Testing in Public Health Laboratories, 2010

The Association of Public Health Laboratories and the Centers for Disease Prevention and Control fielded an online survey in 2011 to characterize the role of public health laboratories (PHLs) in STD prevention. The objective of this survey was to determine current STD testing capabilities and capacities of state and local PHLs over the period of January 1, 2010–December 31, 2010. The survey aimed to gather data from 96 state and local public health laboratories within the United States on overall capacities and capabilities as well disease-specific information. Of note, the first NAAT for *T. vaginalis* was FDA-cleared in 2011 and was not assessed in this survey.

As of 2010, the capability of testing for *Trichomonas vaginalis* was limited in public health laboratories. Of the 60 state and local PHLs that responded to *T. vaginalis* specific questions in the survey, 12 (20%) provided in-house testing for *T. vaginalis*. Nearly all of the PHLs providing *T. vaginalis* testing were local PHLs with only one state PHL providing in-house testing. Two local PHLs referred testing outside of the PHL system and the remaining 47 PHLs did not provide any type of in-house testing for *T. vaginalis*.

Of the 12 laboratories that did provide in-house testing, five provided culture (four used InPouch TV and one used Diamond broth) and 10 provided wet mount testing services. Other existing diagnostic tests such as the Affirm VPIII, PCR and Xenostrip (now OSOM) were unavailable at these PHLs.

Of the two local PHLs who referred testing, culture, wet mount, Affirm VPIII, PCR and Xenostrip (now OSOM) were listed as testing services that could be sent out of the PHL system.



Of the 12 PHLs who provide in-house testing, 10 reported test volume data. At these laboratories in 2010, a total of 9,424 specimens were tested with 691 (7.3%) specimens reported as positive for *T. vaginalis*.

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